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**STEREO AUDIO HEADSET INTERFACE AND METHOD THAT IS
COMPATIBLE WITH MONO HEADSETS**

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BACKGROUND OF THE INVENTION

Field of the Invention (Technical Field):

20 The present invention relates to the field of audio headsets, in particular to the field of mono and stereo headset interface with audio playback devices.

Background Art:

25 Audio playback devices including radios, cassette tape players, compact disc players, digital audio tape players, and the like, are used to produce acoustic signals from prerecorded audio and broadcasted audio information. Depending upon the output configuration of the playback device and the recording format, audio information is output from the audio playback

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device in either mono or stereo format. Other audio formats are available but are not discussed here. A mono formatted recording provides audio information on a single mono channel, while a stereo formatted recording provides different audio information on each of multiple channels, typically left and right. The result of audio information recorded in a stereo format is that the user
5 perceives a broader spaced sound that more accurately reproduces the sound from a live performance. Audio output from audio playback devices is sent to a speaker or speakers integral to the device, speakers remotely located from the device, or from speakers that are in close proximity to a listener's ears, commonly referred to as headsets or headphones.

When an audio playback device operating in stereo mode is connected to a stereo
10 headset having left and right outputs, a stereo headset driver associated with the audio playback device provides the amplification necessary to drive the speakers in the headset. The headset is connected to a headset plug having electrically-isolated conductors for audio left, audio right, and ground, and a microphone input if the headset is equipped with a microphone for communication input to the playback device. A microphone input would be appropriate if the playback device is,
15 for example, a mobile communication device, such as a cellular telephone. The headset plug fits into a mating headset jack located on the audio playback device. The headset jack interfaces with the audio left, audio right, ground and microphone inputs from the headset.

Typically a single power supply configuration supplies power to the headset driver of the audio playback device, resulting in a DC voltage level at the left and right outputs of the driver
20 between ground and the single supply. For that reason, DC blocking capacitors are placed on the audio left and audio right signals between the headset driver and headset jack to filter the DC voltage from the signal.

When the stereo audio playback device is used to drive a mono headset, such as when a mono headset is plugged into the stereo headset jack of the playback device, the audio right
25 signal is shorted to ground through the ground conductor of the mono headset plug. This occurs because the mono headset plug has just three conductors, ground, audio left, and microphone. When plugged into the stereo headset jack of the playback device, the microphone, ground and

audio left interfaces of the headset jack align properly with those of the headset plug, but the audio right interface from the headset jack contacts the ground portion of the headset plug. Thus, when a mono headset plug is plugged into a stereo headset jack, excessive electrical current is drawn from the power supply by the headset driver because one of the audio outputs is grounded
5 instead of being connected to the proper impedance load. This results in excessive heating of the headset driver and possible damage to the headset driver. For this reason audio playback devices that provide stereo output through a stereo jack are not compatible with standard mono headsets.

Devices used for wireless communication, including mobile cellular and satellite
10 telephones, pagers, personal digital assistants (PDAs), and the like (hereafter "mobile communication devices") conventionally provide mono playback of audio information. Headsets having a speaker sized for placement in the vicinity of the left or right ear of a user are often employed in conjunction with mobile communication devices to accommodate "hands-free" communication. The speaker is typically connected via a hard-wire connection to the mobile
15 communication device through a headset jack on the device. As mobile technology advances, mobile communication devices will provide stereo audio output. A mobile configured to provide stereo audio output will not be compatible with existing standard mono headsets due to the incompatibility of mono headset plugs to stereo headset jacks.

It would be advantageous if a headset interface of an audio playback device that outputs
20 stereo formatted audio information was compatible with both stereo and mono headsets. Such an interface would provide the user the capability to use standard mono headsets with audio playback devices that output stereo audio.

SUMMARY OF THE INVENTION (DISCLOSURE OF THE INVENTION)

25 A primary object of the present invention is to provide a headset interface that is compatible with either a stereo or a mono headset. Another primary object of the present

invention is to prevent excessive electrical current draw from a power supply of the playback device when a mono headset is plugged into the headset jack of the playback device.

The present invention is a stereo headset interface that is compatible with mono for an audio playback device. A load in series between an audio output from a stereo headset driver
5 and a ground of a mono headset plug prevents the audio output from being grounded when a mono headset plug is inserted into the stereo headset jack of the playback device.

A primary advantage of the present invention is that a conventional mono headset can be used with a stereo audio playback device. Another primary advantage of the present invention is that a mono headset used with a stereo playback device will not cause overheating or damage to
10 the playback device.

Other objects, advantages and novel features, and further scope of applicability of the present invention will be set forth in part in the detailed description to follow, taken in conjunction with the accompanying drawings, and in part will become apparent to those skilled in the art upon examination of the following, or may be learned by practice of the invention. The objects and
15 advantages of the invention may be realized and attained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated into and form a part of the
20 specification, illustrate different embodiments of the present invention and, together with the description, serve to explain the principles of the invention. The drawings are only for the purpose of illustrating these embodiments of the invention and are not to be construed as limiting the invention. In the drawings:

Fig. 1 is a schematic diagram of a first embodiment of the present invention for a stereo
25 headset interface that is compatible with mono for an audio playback device; and

Fig. 2 is a schematic diagram of a second, preferred embodiment of the present invention for a stereo headset interface that is compatible with mono for an audio playback device.

DESCRIPTION OF THE PREFERRED EMBODIMENTS
(BEST MODES FOR CARRYING OUT THE INVENTION)

The present invention is a method and apparatus for allowing a stereo audio playback
5 device to be input to a mono headset without excessive power drain to the headset driver.
Referring to Fig. 1, a schematic diagram of the present invention for a stereo headset interface
that is compatible with mono is shown in an audio playback device that outputs stereo audio.
Playback device **10** is in communication with a mono headset **12** when headset plug **16** of mono
headset **12** is plugged into headset jack **14** of playback device **10**. Mono headset speaker **40** and
10 microphone **42** are shown on headset **12**.

Mono headset plug **16** comprises electrically-isolated ground conductor **18**, microphone
conductor **20**, and audio conductor **22**. When plugged into headset jack **14**, ground conductor **18**
is in contact with ground **24** of headset jack **14**, microphone conductor **20** is in contact with
microphone input **26** of headset jack **14**, and audio conductor **22** is in contact with audio left
15 output **28** of headset jack **14**. The audio signal from the audio right output of stereo headset
driver **32** is in contact with ground **18** of headset plug **16** due to the configuration of the mono
headset plug **16**.

Power supply **30** provides power to stereo headset driver **32** which provides audio
amplification for the audio signal to headset **12**. Blocking capacitors **34** filter DC voltage from
20 headset driver **32**. Resistance **36** is located in the signal path between headset driver **32** and
headset jack **14** so that audio right output **38** from headset driver **32** passes through resistance
36 prior to being output through headset jack **14** to headset plug **16**. It will be understood by
those of skill in the art that resistance **36** can alternatively be located in the signal path of audio
left output **28** from headset driver **32**, should the configuration of the mono headset plug be such
25 that audio left contacts ground upon being plugged into the headset jack, instead of audio right.

Resistance **36** prevents or reduces damage to headset driver **32** by providing a load to
audio right output **38** preventing audio right output **38** from directly contacting ground **18**. The

value of resistance **36** is equal to or greater than the minimum impedance or resistance that headset driver **32** is configured to drive. Audio left **28** drives mono headset speaker **40**.

When a stereo headset is plugged into headset jack **14** of audio playback device **10**, the amplitude of audio right output **38** is increased to compensate for the reduced power received by the right speaker of the stereo headset due to resistance **36** in the signal path.

Referring to Fig. 2, a schematic diagram of a second, preferred embodiment of the present invention for a stereo headset interface that is compatible with mono is shown. Fig. 2 shows the invention in operation when connected to a stereo headset **44**. Left speaker **46**, right speaker **48**, and microphone **42** are shown on stereo headset **44**. Stereo headset plug **50** comprises electrically-isolated ground conductor **52**, microphone conductor **54**, left audio conductor **56**, and right audio conductor **58**. When plugged into headset jack **14**, ground conductor **52** is in contact with ground **24** of headset jack **14**, microphone conductor **54** is in contact with microphone input **26** of headset jack **14**, left audio conductor **56** is in contact with audio left output **28** of headset jack **14**, and right audio conductor **58** is in contact with audio right output **60** of headset jack **14**.

In the second embodiment of Fig. 2, resistances **62** and **64** are placed on both audio left and audio right output signal paths respectively in order to balance the audio output when headset driver **32** is driving a stereo headset. Resistance **62** is equal to resistance **64** so that audio left **28** and audio right **60** are both adjusted down by the same amplitude when driving a stereo headset. When driving a mono headset, such as that depicted in Fig. 1, the embodiment shown in Fig. 2 provides resistance **64** to audio right so that it is not shorted to ground.

In a third embodiment of the present invention, a detector is used to identify when a mono headset is plugged into the stereo headset jack of the playback device. When a mono headset is detected, audio right output is switched off, while audio left output remains on. The mono headset is then driven by audio left only. A mono headset has been plugged into the stereo headset jack when audio right has been grounded.

Although the invention has been described in detail with particular reference to these preferred embodiments, other embodiments can achieve the same results. Variations and modifications of the present invention will be obvious to those skilled in the art and it is intended to cover in the appended claims all such modifications and equivalents.